Self-leveling elastic waterproofing coating

1. Sumary

At present, green coatings only account for 8% of the architectural waterproofing coatings in China, is 1/5-1/6 in relative to that in United States and Germany. The amount of volatile organics (VOC) discharged per year is about 350,000 tons, which seriously pollute the environment, and 1.2 billions of solvent is wasted. Thus, it is imminent to develop and use novel type green architectural waterproofing material.

Green self-leveling elastic waterproofing coating is a new type waterproofing coating comprising chlorosulfonated polyethylene and modified rubber emulsion as base materials, fly-ash and cement as fillers, and a suitable amount of auxiliaries. This coating is characterized by non-toxic, no pollution, high strength, excellent elasticity, good waterproofing effect and self-leveling property. A uniform, continuous and flat coating film having a thickness above 2.0 mm can be formed by once working. The coating is suitable for working at a low temperature condition of about 0°C. The coating overcomes the shortcomings of common aqueous architectural waterproofing coatings with respect to poor effect in thick coating and not capable of being used at low temperature. A satisfactory effect has been acquired by applying this coating to architectural waterproofing construction in Qingdao, Beijing and etc.

2. Materials of the coating

2.1 Base materials

Chlorosulfonated polyethylene (CSM) emulsion and modified rubber emulsion (E) are used as base materials. CSM is characterized by excellent weather resistance, high elasticity, difficult-to-burn, water resistance, and resistance to acid, alkali, salt and chemicals. The modified rubber emulsion is characterized by good film-forming property, high elasticity, and good cold endurance, which can improve the film-forming, leveling and low temperature film-forming properties of coating. A self-leveling elastic waterproofing coating with high strength and high elasticity and capable of forming film at low temperature can be formulated by using chlorosulfonated polyethylene and

Received Time 16.Sep. 11:17 Print Time 16.Sep. 11:18

modified rubber emulsion as base materials together with the addition of suitable auxiliaries and fillers.

2.2 Auxiliaries

In order to meet the requirements of the coating film with regard to the technological properties of self-leveling and low temperature film-forming and to the physical-mechanical properties of high strength and high elasticity, some suitable types of auxiliaries at suitable amounts shall be added.

The addition of plasticizer and film-forming auxiliary to a polymer can reduce the action force among chains of the polymer, which, therefore, decreases the glass transition temperature Tg and the minimal film-forming temperature MFT, and increases the film-forming ability at room temperature and low temperature. Thus, plasticizer and film-forming auxiliary are used in an amount of 20-40% and 1-2%, respectively.

Cellulose derivative type thickening agent belongs to a non-structural thickening agent, which can increase the viscosity of the coating by increasing the viscosity of disperse phase, thereby achieving the object of improving the film-forming and leveling properties. The amount of the thickening agent is about 0.1%.

2.3 Fillers

Fillers have a certain influence on the properties of the coating including film-forming property, flowability, low temperature stability and strength. Fly-ash and quartz have low water absorption, and thus are superior to other fillers such as light calcium carbonate and talc with respect to the film-forming property and flowability of the coating formulated. However, quartz coating has poor low temperature stability, so fly-ash is selected as the filler. In addition, a suitable amount of cement is added for improving the strength of the coating. The common cement is preferred, and its amount shall not be too much; otherwise, the elasticity, plasticity and self-leveling property of the coating will be affected. By experiment, the filler-to-base material ratio is determined as 2.5-3.0:1.

3. Performances and features of the materials

3.1 Performances

The performance indexes and test results of the green self-leveling elastic

waterproofing coating are listed in Table 1.

Table 1 The performance indexes and test results of F-CS emulsion elastic waterproofing coating

Items		Indexes	Test results
Solid content(%)	not less than	50	68
Tensile strength (MPa) not less than	no treatment	1.0	2.2
	heat treatment	0.8	2.6
	alkali treatment	0.8	1.8
	UV treatment	0.8	1.7
	acid treatment	0.8	1.75
Heat resistance no flow, bubbling and sliding (°C)		>90	120
Elongation (%)	no treatment	≥100	195
	heat treatment	≥80	150
	alkali treatment	≥80	155
	acid treatment	≥80	140
	UV treatment	≥80	135
Low temperature flexibility (°C)		-20	-25
Waterproof	no leakage	0.3MPa, 30 min	0.3MPa, 30 min
Minimal film-forming temperature (°C)		0~5	-1~-2
Self-leveling property		self leveling of a film having a thickness of above 2 mm	Pass

3.2 Features

(1) No toxicity, no pollution, environment friendly

The coating includes water as medium, and is free of organic solvent, non-toxic and odorless. The use of this coating can save a large quantity of irreproducible sources, and effectively reduce environmental pollution. The process for the production of said coating discharges no waste (three wastes), and is reliable and safe.

(2) Good waterproof

The coating is characterized by high tensile strength, good elasticity, excellent heat resistance, good low temperature flexibility, excellent weather resistance, good resistance to acid, alkali, salt and chemicals, good cohesiveness, strong adaptability to deformation of substrate material, no ageing-fracture after long period of use, and good waterproof.

(3) Suitable for use at a low temperature of about 0°C

Since the components of the base material have a relatively lower Tg, being from -45°C to -70°C, the coating has a MFT of from –1 to -2°C, and thus is suitable for use at a low temperature of about 0°C.

(4) Self-leveling property

By using suitable modified rubber emulsion, auxiliaries and fillers, the coating is endowed with the property of self leveling. A uniform, continuous and flat coating film having a thickness of above 2.0 mm can be formed by once working. The working with the coating is highly efficient and convenient.

(5) Others

The working with the coating can be carried out in a damp environment and on a damp basement layer, which is not affected by water content of the basement layer. The coating can be diluted with water to adjust the viscosity thereof. The working tools can be washed with water.

4. Application

In the first step, a basement layer is prepared. The basement layer is cleaned to remove ash and dirt on the surface. The surface of the basement layer shall be flat, clean, and no blow hole and pore. Beehive and surface pockmark on the basement layer shall be repaired with aqueous putty before working. The working is not affected by water content of the basement layer, but the site being in leakage shall be firstly treated to stop leaking.

The second step relates to mixing the materials. Firstly, liquid materials are homogeneously stirred with an electric agitator (200-300 r/min) for about 2-3 mins, to which powdery materials are gradually added in a ratio of 1-1.5:1, and

then the mixture is stirred for further about 10 mins.

Finally, the mixture is uniformly cast on the surface of the basement layer in an amount of 3-3.5 kg/m^2 (based on a dry film of 2 mm thick). Then, the film thus obtained is subjected to curing for 24-26 hours before putting into use.

The working conditions: environmental temperature is not less than 0°C, and relative humidity is not greater than 90%.

The green self-leveling elastic waterproofing coating is suitable for waterproof, dampproof, leakage-proof and leakage repair of roofing, outer wall, underground, bathroom and toilet room in house architectural construction, and is also appropriate for waterproof and dampproof of underground construction and facilities such as road, bridge, irrigation works and tunnels.

103: 182767f **Surfactant admixtures for concrete.** Kao Corp. **Jpn. Kokai Tokkyo Koho JP 60,127,253 [85,127,253]** (Cl. C04B24/24), 06 Jul 1985, Appl. 83/233,915, 12 Dec 1983; 7 pp. The admixts. contain substances composed of a nonionic surfactant 50–95 and a cationic surfactant 5–50 parts. The nonionic surfactants are preferably selected from polyethylene glycol alkyl ether, polyethylene glycol alkylphenyl ether, and alkanolamide. The cationic surfactants are preferably selected from alkyltrimethylammonium halide, alkyldimethylbenzylammonium halide, and alkylpyridinium halide. The admixts. improve the mech. strength, external appearance, and workability of concrete blocks for civil engineering, and hollow concrete blocks for buildings, both blocks being manufd. by the immediate mold release method. Thus, ordinary portland cement, river sand, and water were mixed with a chem. admixt. composed of p-$C_9H_{19}C_6H_4O(CH_2CH_2O)_9H$ [26027-38-3] 95, and $RN^+(CH_3)_3Cl^-$ (R = C_{12-14} linear chain alkyl) 5 wt.% (chem. admixt.–cement wt. ratio of 0.025%), cast by vibration compaction, and immediately released from a mold to show increased filling rate, significantly increased compressive strength (after curing in water), and excellent external appearance.

103: 182768g **Concrete mixes.** Grzegorzewski, Wiktor (Instytut Techniki Budowlanej) **Pol. PL 125,440** (Cl. C04B15/00), 30 Mar 1985, Appl. 216,454, 20 Jun 1979; 2 pp. An aggregate for concrete mixts. consists of 60–90 basic aggregate >1 mm diam. and 10–40 wt. parts supplementary aggregate. The particle size of the latter is smaller or equal to 15% of the smallest particles of the basic aggregate and smaller or equal to 25% of the smallest particles of the basic aggregate if the basic aggregate has a particle size >2 mm or <2 mm, resp. Thus, the aggregate consisted of 1670 kg basic aggregate fraction 1–2 mm diam. and 584 kg supplementary fraction 0.025 mm diam. The entire aggregate was mixed with 350 kg cement and 175 L water. The 28-day strength of cylindrical specimens 8 cm in diam. and 8 cm high was 31.1 MPa.

103: 182769h **Expanding agent for crushing natural rocks and construction materials.** Eckler, Hans Otto; Bergholz, Wolfgang; Grosch, Peter; Deylig, Waltraut; Korth, Dietrich (Bauakademie der DDR, Institut fuer Baustoffe) **Ger. (East) DD 221,992** (Cl. C04B2/02), 08 May 1985, Appl. 257,336, 01 Dec 1983; 10 pp. An expanding agent comprises 30–92% com. burnt lime with grain size 90% <90 μ and CaO content ≥85%, i.e., with ≤5% inactive burnt lime, which had been kept at 40–70% relative humidity, as well as cement 5–70, burnt gypsum 0.2–1, plasticizers and optionally retardants 0.2–4%, and enough water to give a castable pulp. Thus, 59.1% burnt lime contg. 93% CaO and with 95% <90 μ particles and Blaine value 4000 cm²/g was mixed with portland cement 11.8, burnt gypsum 0.3, heavy duty liquefier *Viskoment* [81690-71-3], and make-up water 19.0% to give a pulp with water–solids ratio 0.36. After 3 days in a test cylinder the product created a swelling pressure of 34 N/mm². Injection of the mixt. into a 20 mm diam. borehole in a 20 × 20 × 20 cm concrete cube with compressive strength ~25 N/mm² demolished the cube in 2 days.

103: 182770b **Treatment of concrete.** Hartel, Wolfgang (VEB Kreisbaubetrieb Zeitz) **Ger. (East) DD 221,995** (Cl. C04B24/30), 08 May 1985, Appl. 258,510, 23 Dec 1983; 5 pp. A process for treating concrete prepd. with *urea* [57-13-6] or urea–contg. additives consists of contacting the concrete with an aldehyde or aldehyde mixt., preferably aq. HCHO [50-00-0] soln. Thus, an ordinary concrete mixt. prepd. with urea 3% (based on cement) emitted NH_3 during hardening. A concrete sample was treated with 35% aq. soln. of HCHO in an equimolar amt. based on the urea content, and after a short drying time there was no more NH_3 emission.

103: 182771c **Additive for concrete and its rheological characteristics.** Alvarez Berenguer, Antonio; Vivero Gomez-Elvira, Rodrigo (Tolsa S. A.) **Span. ES 521,131** (Cl. C04B31/02), 01 Jun 1984, Appl. 30 Mar 1983; 16 pp. An additive to improve the rheol. properties of concrete, using sepiolite as basic constituent, is prepd. by selecting the mineral by drilling before extn., air-drying the mineral to a moisture content of 30–40%, grinding to an av. particle size of 3 mm, drying in a rotary drum at 75–80° to a moisture content of 13–15%, and classifying the particles by sieves so that 95% are 125–437 μ. A pre-gel is continuously formed by pre-gelling a 15–25% suspension, obtained by agitating the product at 3000 rpm for 20 min; addn. of the dild. pre-gel to concrete led to a substantial improvement in the rheol. properties compared to direct addn. of the dispersed form. Thus, addn. of 0.15 and 0.3% of the additive to concrete with water–cement ratio 0.65 gave consistency 6–7 and 4, resp., by the Abrams cone test, vs. 12 without the additive. The concrete is more plastic and more tractable even in dry crushing.

103: 182772d **Expanding additive for slag-alkaline binders.** Sheinich, L. A.; Glukhovskii, V. D.; Runova, R. F.; Kavalerova, E. S.; Rumyna, D. A. (Kiev Construction-Engineering Institute) **U.S.S.R. SU 1,165,657** (Cl. C04B7/153), 07 Jul 1985, Appl. 3,675,966, 20 Dec 1983. From *Otkrytiya, Izobret.* 1985, (25), 88. Additives for concrete with increased degree of expansion and crack resistance contain 25–31 Fe oxide, 61–71 wt.% Na sulfate, and the balance MgO.

103: 182773e **Lightweight concrete mixture.** Auerbach, Joachim **Ger. Offen. DE 3,407,557** (Cl. C04B14/14), 05 Sep 1985, Appl. 01 Mar 1984; 6 pp. Lightwt. concrete mixes, which are combined with water to prep. prefabricated floors, walls, and roofs or finished building materials, e.g., with heat cond. 0.3–0.65 W/m-K, contain 0.1–16 mm sifted lava granules and cement, e.g., in a (3–6):1 ratio, and optionally a plasticizer.

103: 182774f **Additive for concrete or similar materials and material containing these additives.** Ferrari, Giorgio (Modern Advanced Concrete S.p.A. (MAC)) **Belg. BE 902,183** (Cl. C08G), 31 Jul 1985, IT Appl. 85/19,183, 22 Jan 1985; 14 pp. Dispersants for inorg. binders are prepd. on the basis of a water-sol. sulfonated synthetic polymer by passing an aq. soln. of these polymers across an ultrafiltration membrane with a nominal cut-off value of 500–1,000,000 mol. wt. units, e.g., 1000–100,000 units. Construction materials from inorg. binders and fillers may contain 0.01–30 wt.% of a soln. of a water-sol. sulfonated polymer after ultrafiltration. Thus, 600 g of a 20 wt.% soln. of the Na salt of sulfonated polystyrene was dialyzed for 48 h across an ultrafiltration membrane with nominal cutoff of 100,000 mol. wt. units and 400 g was recovered. Cement mortars prepd. using 2 wt.% additives after ultrafiltration required a water–cement ratio of 0.32 to give the same viscosity as prepns. using 2 wt.% of the same additives without ultrafiltration with water–cement ratio 0.39 and prepns. without additives with ratio 0.45. The resp. 28-day flexural and compressive strengths were 92 and 772, 60 and 585, and 65 and 505 kg/cm².

103: 182775g **Additive for concrete mixtures.** Beran, Jaroslav; Simonides, Jan **Czech. CS 222,134** (Cl. C04B31/10), 15 Jul 1985, Appl. 81/8,548, 20 Nov 1981; 5 pp. Plasticizers which increase the final strength of concretes were prepd. by mixing flue dust with sulfonation products of a great variety of org. substances, such as petroleum products, glucose, molasses, starch, fats, and oils. Thus, a mixt. of 100 kg flue dust, 5 kg tar, and 2 kg molasses was treated at 80° for 20 min with 4 kg 50% H_2SO_4 and the product (84 kg) was worked up as usual with 420 kg cement, 1570 kg aggregates, and 189 L water. The concrete had 7- and 28-day compressive strength 19 and 29.9 MPa vs. 11.2 and 17.7 MPa in a parallel batch free of the additive. L. J. Urbanek

103: 182776h **Mixture for autoclaved lime-silica concrete.** Vrbecky, Jan; Rihanek, Stanislav **Czech. CS 222,361** (Cl. C04B15/06), 15 Aug 1985, Appl. 80/4,174, 13 Jun 1980; 2 pp. Products with physicomech. properties comparable to cement-bonded concretes were prepd. from hydrothermally processed artificial aggregates (AA) and a flue dust-lime binder. Thus, a mixt. of 8 kg flue dust, 1.64 kg powd. lime, and 3.5 L water was pelletized, the pellets were heated 10 h at 1 MPa in a moist atm., and dried at 105° to give AA with bulk d. 880 kg/m³, vol. d. 1580 kg/m³, water sorption 47%, grain size 10–25 mm, and crushing strength 2.25 MPa (dry) and 1.69 MPa (moist). Mixing 1100 kg AA with 450 kg binder (prepd. from a 10:4.3 flue dust–lime mixt.) and 300 L water and heating 10 h at 1 MPa as above gave test bodies which had crushing strength in conformity with the no. 170 concrete std: L. J. Urbanek

103: 182777j **Flowable hydraulic compositions.** Nippon Zeon Co., Ltd. Ohbsyashi-Gumi, Ltd. **Jpn. Kokai Tokkyo Koho JP 60 86,065 [85 86,065]** (Cl. C04B28/08), 15 May 1985, Appl. 83/194,692, 18 Oct 1983; 6 pp. The hydraulic compns. consist of 100 parts of a hydraulic component composed of portland cement 90–10 and granulated blast-furnace slag 10–90 wt.%, 1–30 parts of an expansive agent, 0.05–5 parts of a dispersant, and, as needed, a water-retaining agent, a defoaming agent, and aggregates. The hydraulic compns. are used in finishing concrete slab floors in buildings, and the hydraulic compns. mixed with water and poured on the slabs form a true horizontal surface. Thus, ordinary portland cement 40, Cerament (granulated blast-furnace slag) 60, *Denka CSA 20* [98113-19-0] (ettringite-type expansive agent) 10, Quinflow 540 (dispersant, Na salt of amylene–maleic acid copolymer) 0.3, *Tetronics T-702* [11111-34-5] (defoaming agent) 0.058 *Hi-Metolose 90SH-15000* [96538-32-8] (water-retaining agent) 0.1, water 40, and sea sand 100 parts were mixed to form a slurry. The slurry had high flowability, no bleeding, and no sepn. of the aggregates, and the hardened bodies showed excellent compressive strength (JIS R 5201), a significantly improved smooth surface without cracks, and excellent dimensional stability.

103: 182778k **Alternate production of dolomitic and calcitic lime in the same furnace.** Cordeir, Antonio Carlos Tavares; Antonio, Dioclides (Companhia Siderurgica Nacional) **Braz. Pedido PI BR 83 05,708** (Cl. C04B2/00), 21 May 1985, Appl. 83/5,708, 17 Oct 1983; 22 pp. Dolomitic and calcitic lime are produced alternately in the same kiln without interrupting prodn. or decreasing product quality by programmed control of the vol. of fuel and temp. depending on whether calcite or dolomite is being decompd.

103: 182779m **Cement mortar composition.** Shin-Etsu Chemical Industry Co., Ltd. **Jpn. Kokai Tokkyo Koho JP 60,122,758 [85,122,758]** (Cl. C04B14/02), 01 Jul 1985, Appl. 83/227,997, 02 Dec 1983; 4 pp. The mortar consists of cement, an aq. nonionic cellulose ether, and sepiolite. It has excellent sag resistance, adhesion to tiles, and water retention, and has very few cracks. Thus, portland cement 100, silica sand 100, *Metolose 90SH-15000* [9004-65-3] 0.5, sepiolite (Aid Plus ML-K) 0.5, and water 47 parts were mixed to obtain a mortar which had 28-day tile adhesion 11.2 kg/cm².

103: 182780e **Pneumatic conveying of a fine-grained structural material based on gypsum for underground blowing.** Fink, Frank (Saarbergwerke A.-G.) **Ger. DE 3,442,926** (Cl. E21F17/00), 25 Jul 1985, Appl. 24 Nov 1984; 3 pp. A process for pneumatically feeding a finest-grained gypsum-based building material mixt. with large-grained granules to be blown from above-ground to underground sites uses gypsum from flue gas desulfurization plants as the granules. The gypsum is dried, briquetted, and then ground to the necessary grain size. Granules of ≤25 mm may be added at 20–35 wt.% to the mixt. The granules may be based on β-$CaSO_4.0.5H_2O$ which is briquetted before or after calcination and then ground.

103: 182781f **Solidification catalyst for anhydrite mortar with rapid setting and its use.** Kneip, Edouard **Fr. Demande FR 2,555,158** (Cl. C04B28/16), 24 May 1985, Appl. 83/18,272, 17 Nov

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1985

VOLUME 103 CODEN: CHABA8 103(22) 1-733 (1985) NUMBER 22
ISSN: 0009-2258

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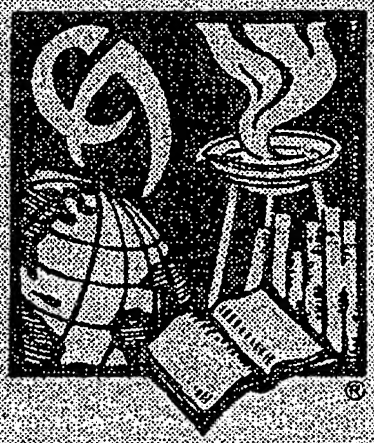

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